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Raytheon Missile Systems - Strike Weapons

Lock-On-After-Launch (LOAL) Maverick

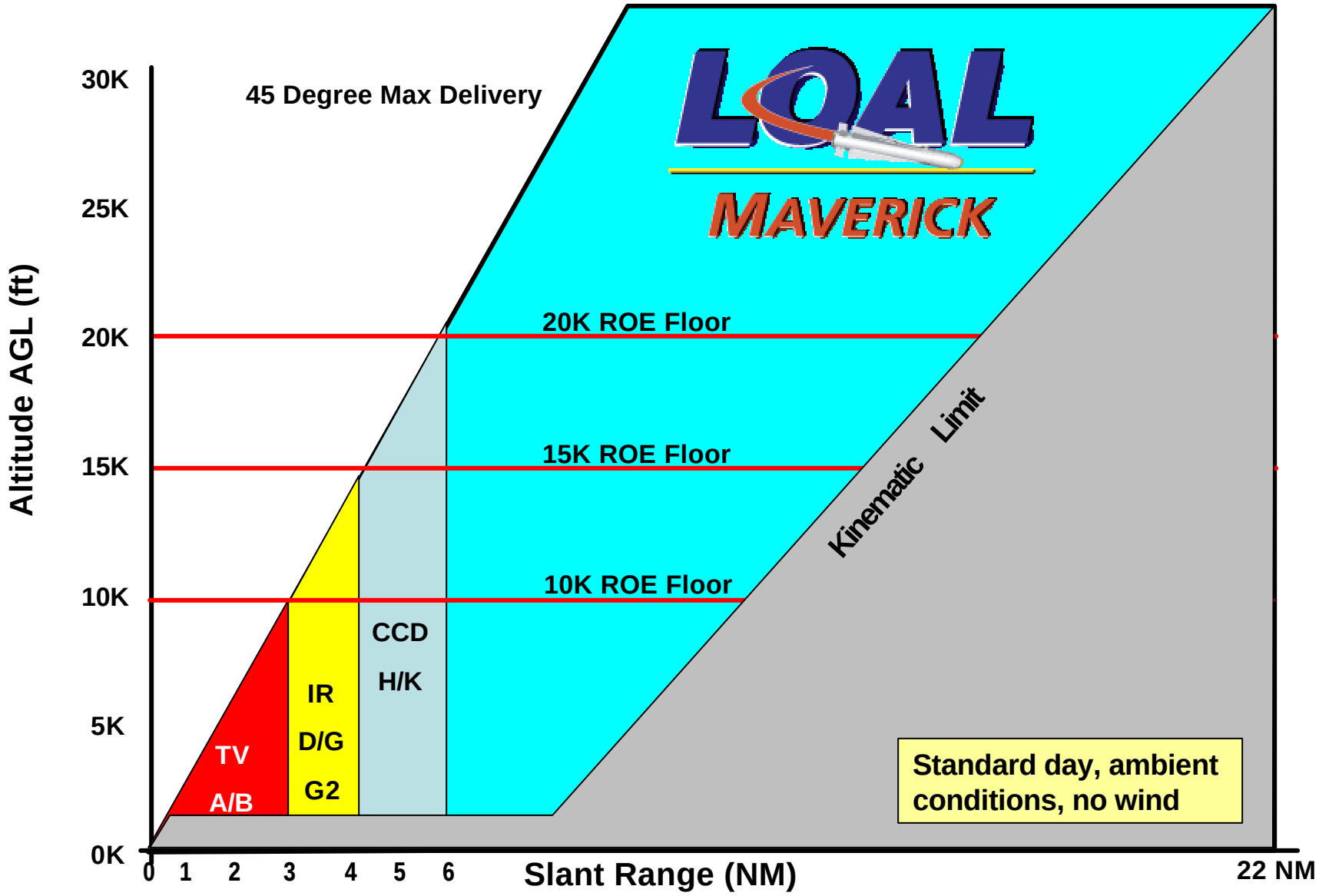
Briefing Outline

- Maverick - Today and Tomorrow
- LOAL Vision
- Weapon Design and Performance
- Datalink Design and Performance
- Capability Options
- Summary

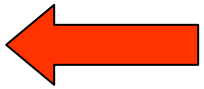
Maverick Current Capabilities

- **Man-In-The-Loop (MITL) lock-on-before-launch and launch-and-leave**
  - **3’ guidance accuracy**
  - **Combat-proven self-track software, against non-contrast-bounded and moving targets**
- **TV, IR, and Laser seekers coupled with 125# and 300# warheads**
  - **Suitable against 89% of CAFs target sets**
  - **Employability limited by weather conditions and/or ROE**
- **Integrated on several USAF, USN and USMC tactical aircraft, plus 25 aircraft in 31 other countries**
- **Comes with an established support / maintenance infrastructure**

Acquisition Range Mach 0.5



Maverick's Exploitable Features

- MITL target ID, lock-on-before-launch and launch-and-leave
  - 3' guidance accuracy using combat-proven tracking software against non-contrast-bounded and targets moving at/after launch
- A mix of TV, IR, and laser seekers with 125# and 300# warheads
  - Small Warhead + MITL Precision Accuracy = Controlled Collateral Damage
- 60-80% of flight envelope not being used today 

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The Niche for LOAL Maverick

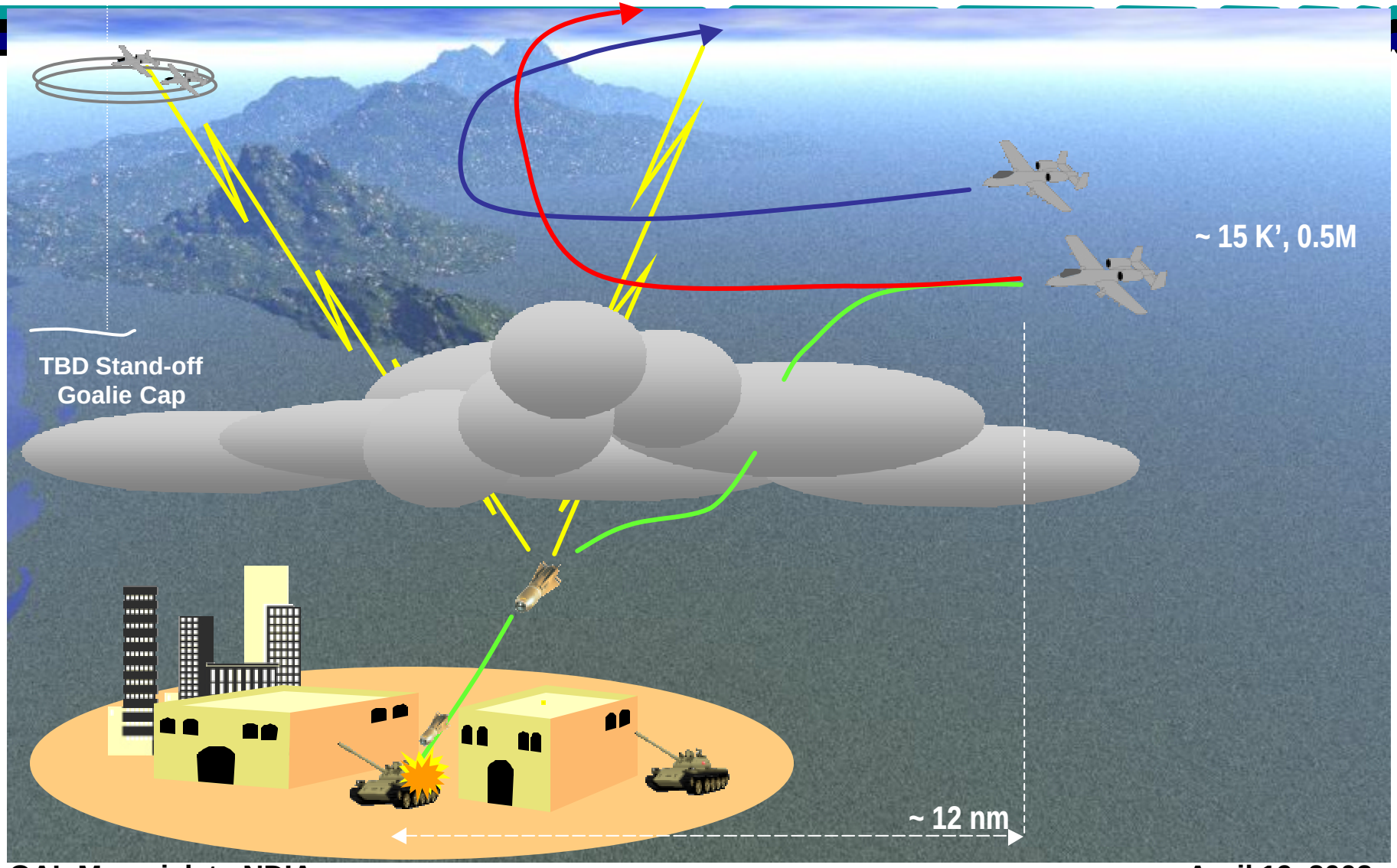
OPERATIONAL

- Increase Employability in Adverse / All-Weather, at ROE-Compliant Altitudes
- Increase Flexibility with Cockpit-Selectable Attack Options
- Increase Standoff / Survivability, still achieving Precision Accuracy
- Make Man-In-The-Loop (MITL) Decisions for Endgame Control / Abort
- Manage Collateral Damage, Avoid Fratricide
  - MITL + Small Warhead + Precision Accuracy = Low Collateral Damage
- Confirm Attack Results Real-Time
- Grow to Enable Precision Engagement Against Targets of Opportunity, including Movers / Movables

KEEP IT SIMPLE AND AFFORDABLE

- Aircraft Integration Independent of OFP
- Little / No SEEK EAGLE
- Large Inventory Available for Upgrade - Timely and Affordable
- Supplement and Complement to Current MITL Weapons Inventory,
- Add-Ons, But No Changes, to Existing Ground Support Equipment

A-10 2-Ship
(shown with Goalie Cap Option)



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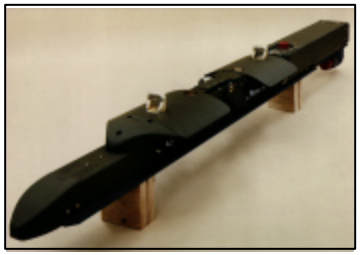
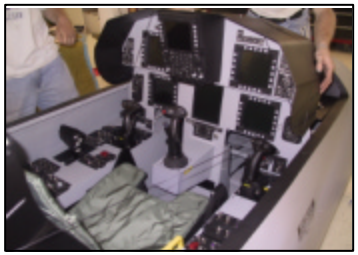
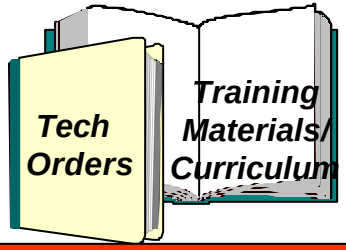
LOAL Maverick System Elements



LAU-117 Launcher
- Contains Datalink

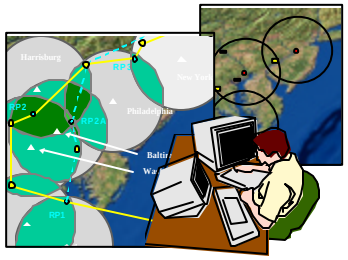


Operator Training



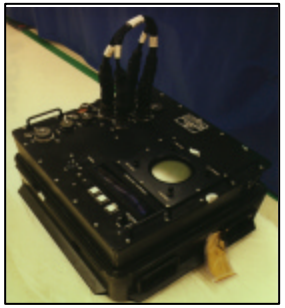
Maverick Weapon Modifications
- GAINS Integration
- WDL Integration
- Software Mechanization

GWEF S/W Validation



Mission Planning Module
- To be developed

A-10
- No OFP Mods Required
- Existing Sta 3/9 Carriage

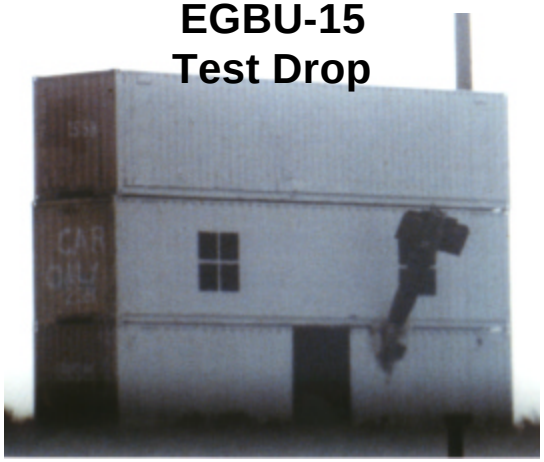


GMTS Field Test Equipment
- No Mods Required

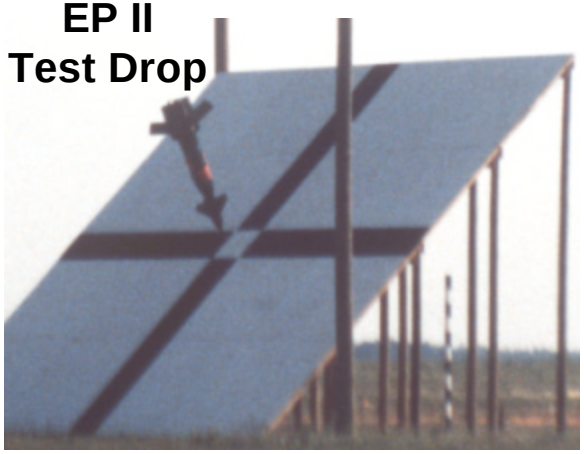
Raytheon to Field and Support All Weapon System Elements

Proven Technology and Performance

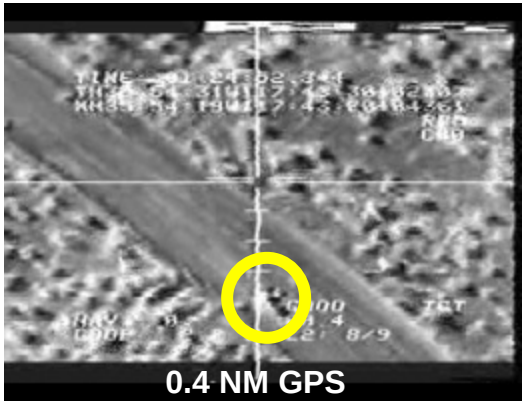
EGBU-15 Test Drop



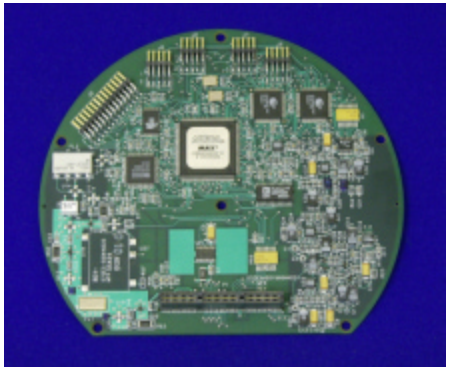
EP II Test Drop



AMSTE Maverick Screen Capture



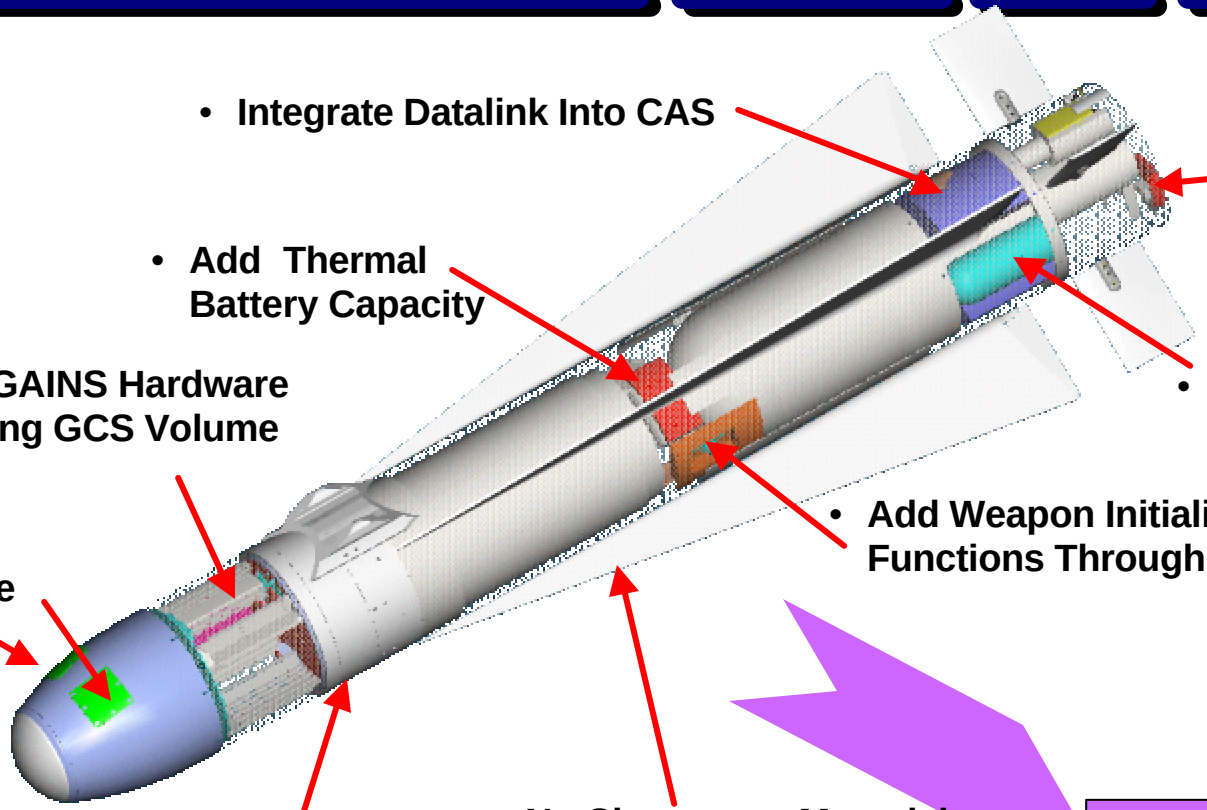
Combat Proven Results



Low-Cost Datalink

Key Technologies Demonstrated on Raytheon Programs

LOAL Weapon Design



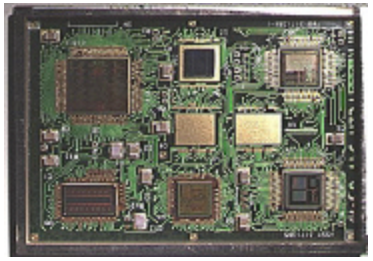
- Integrate Datalink Into CAS
- Add Datalink Antenna
- Add Thermal Battery Capacity
- Integrate GAINS Hardware Into Existing GCS Volume
- Increase Gas Bottle Pressure
- Add Weapon Initialization Functions Through Existing Panel
- Add Flush GPS Antennae
- Add Test Connector Through Existing Bottom Access Panel
- No Changes to Maverick Outer Mold Line or CG

Remove Existing RSA and FDSU

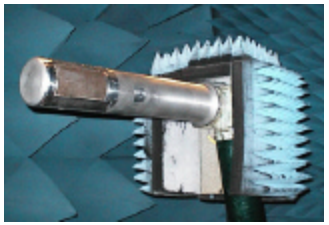
Little / No SEEK EAGLE Flight Tests

Advanced Technology Features

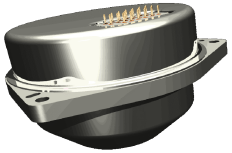
- **Raytheon GPS Receiver**
  - **24-channel fast-acquisition receiver**
  - **Ultra-tight coupling and direct measurement processing provide increase in J/S capability**
  - **Single processor eliminates need for separate CPU CCA**



- **Antenna and low cost analog nuller**
  - **Additional increase in J/S margin**

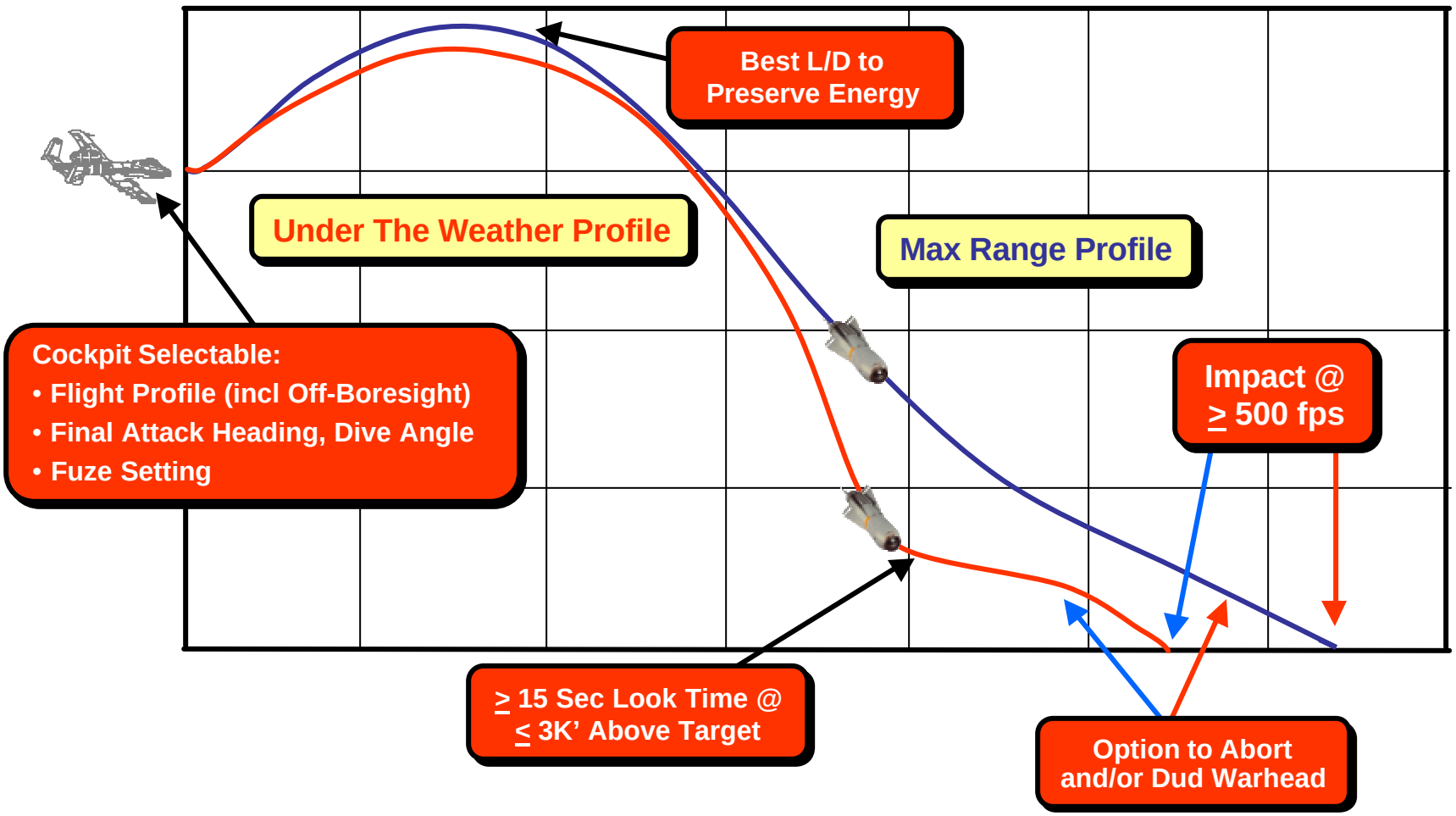


- **MEMS IMU**
  - **Reduced form factor**
  - **Reduced cost**

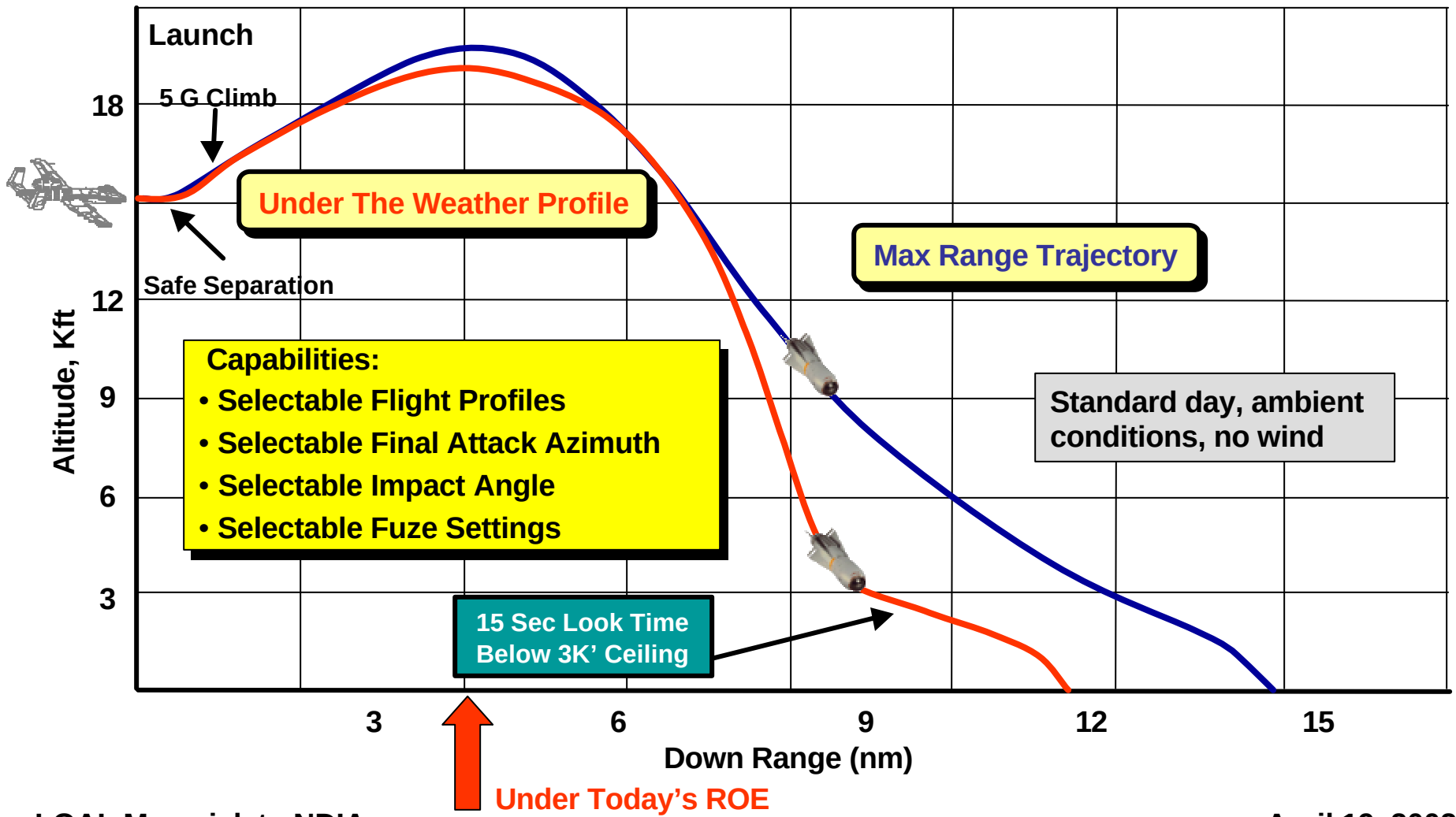


- **Low-Cost Datalink**
  - **Improved Performance**

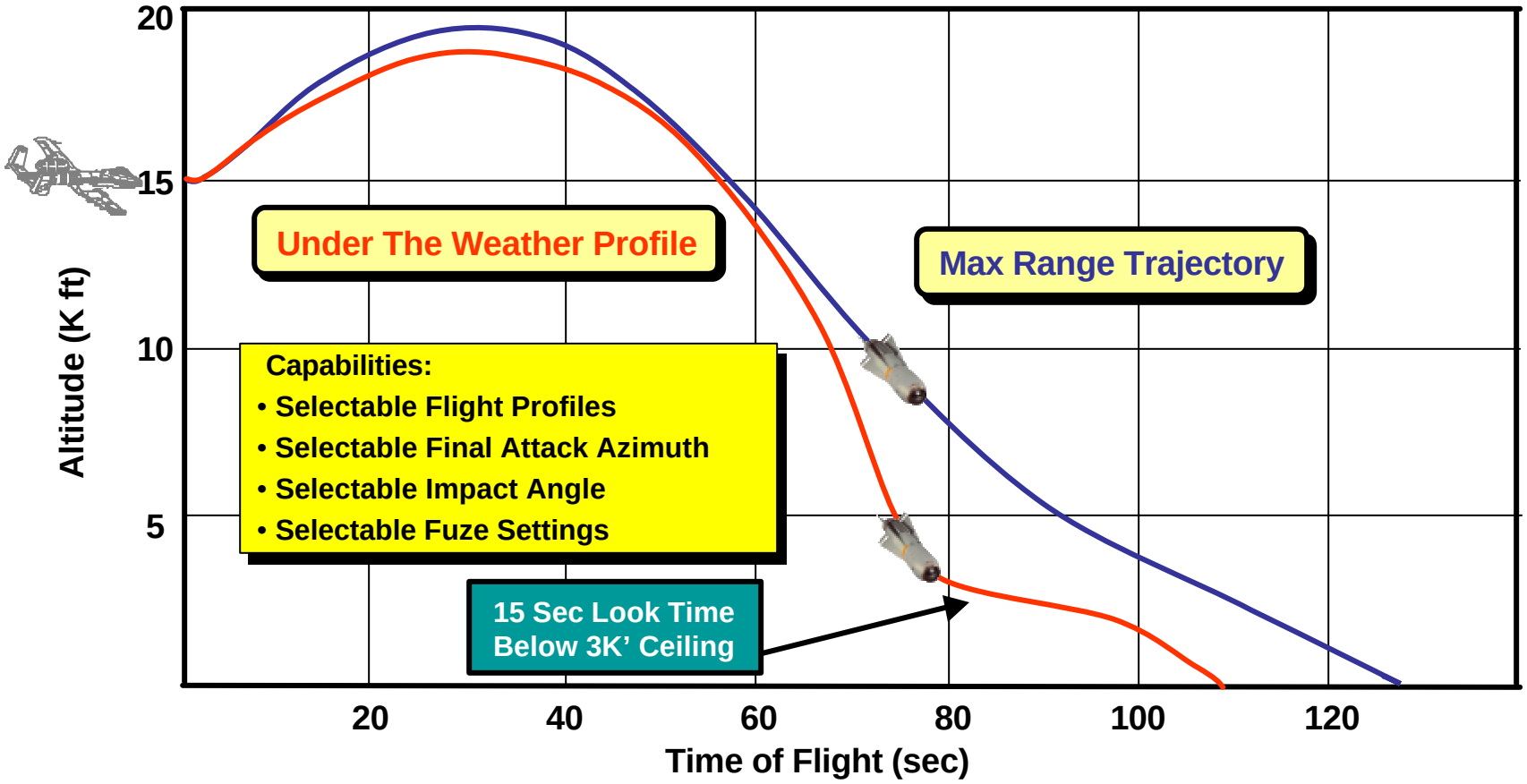
Selectable Attack Profiles



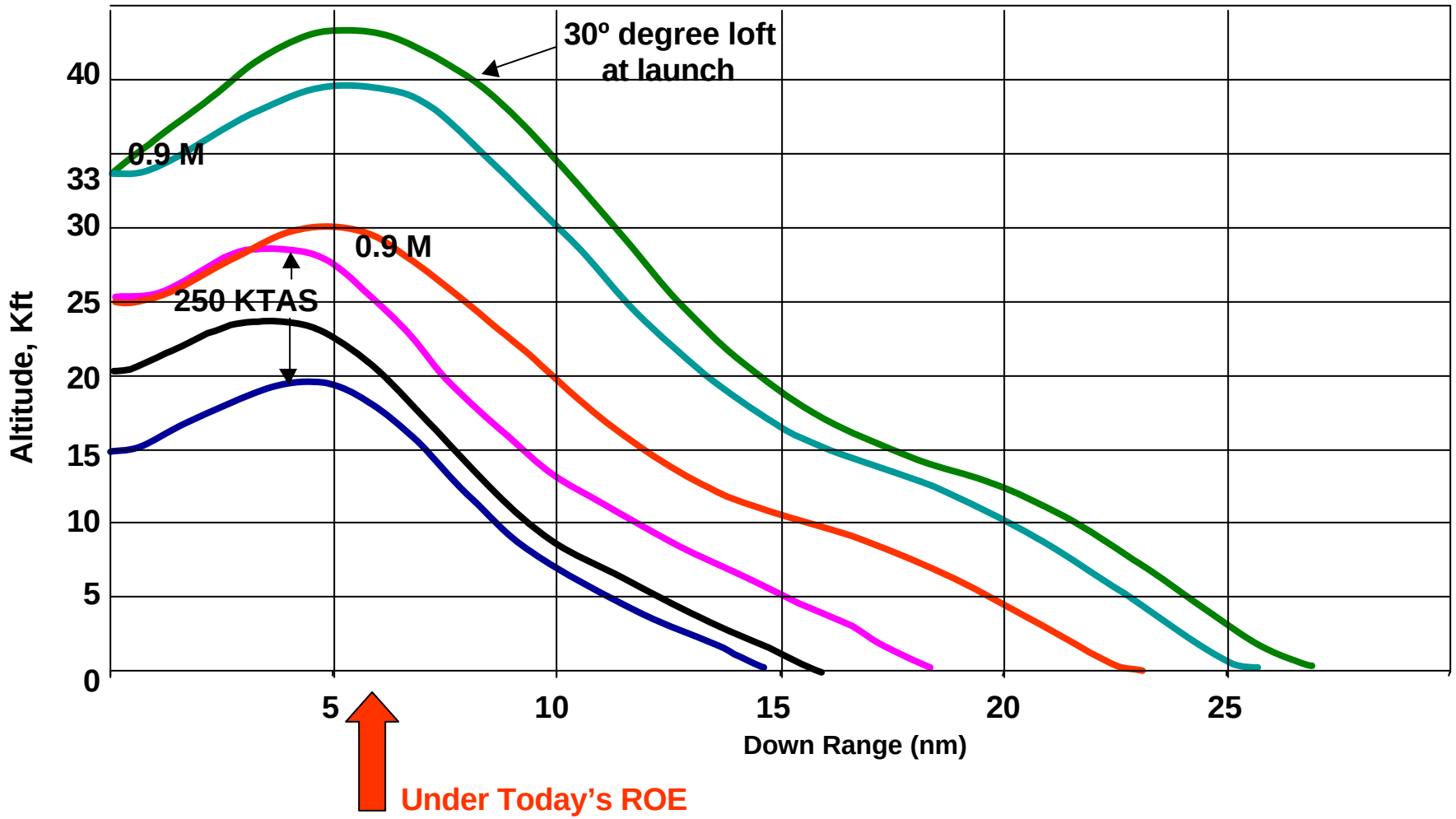
Trajectory Options - Range
Mach 0.5 / 15,000 ft



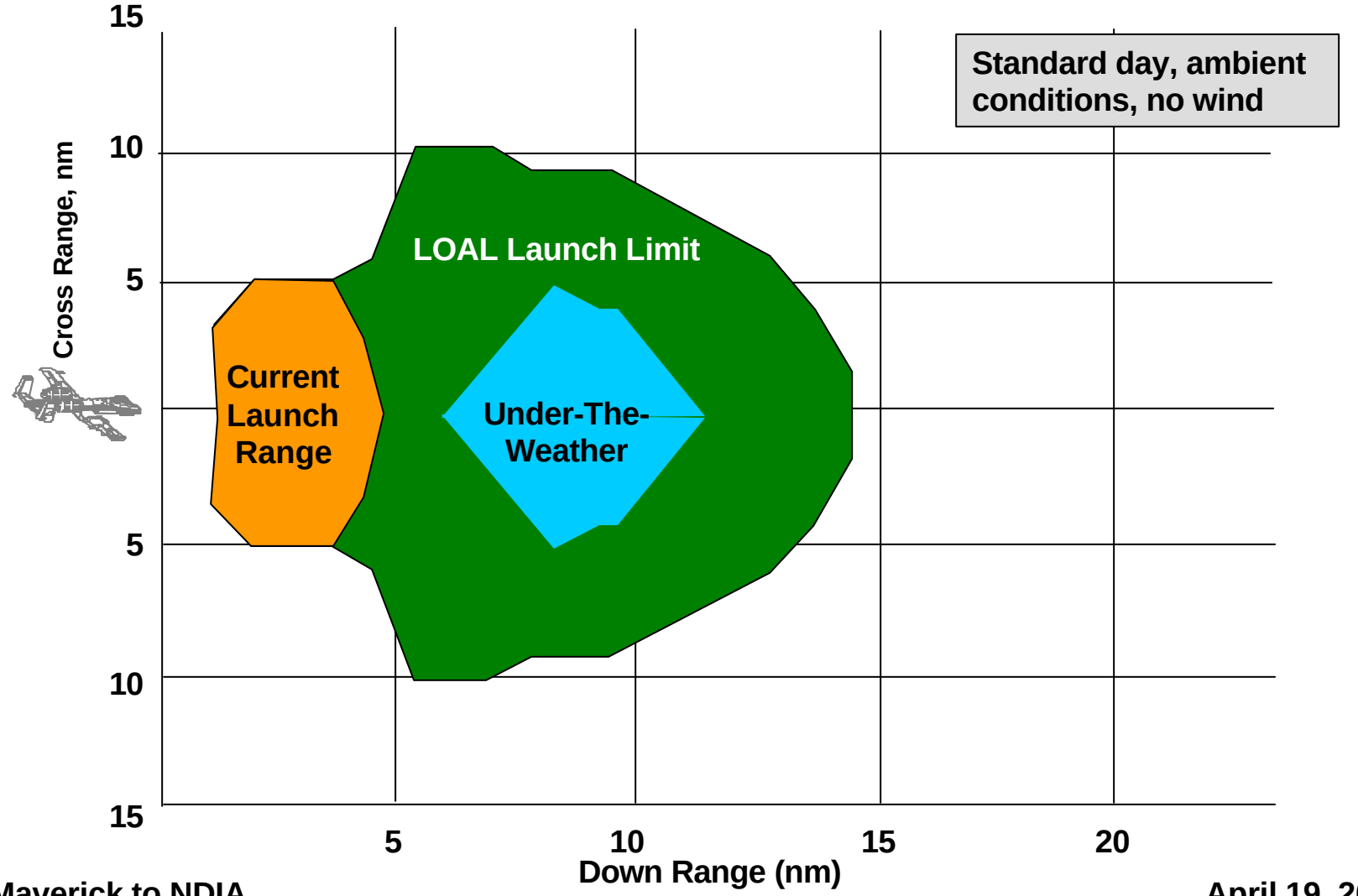
Trajectories - Time of Flight
Mach 0.5 / 15,000 ft



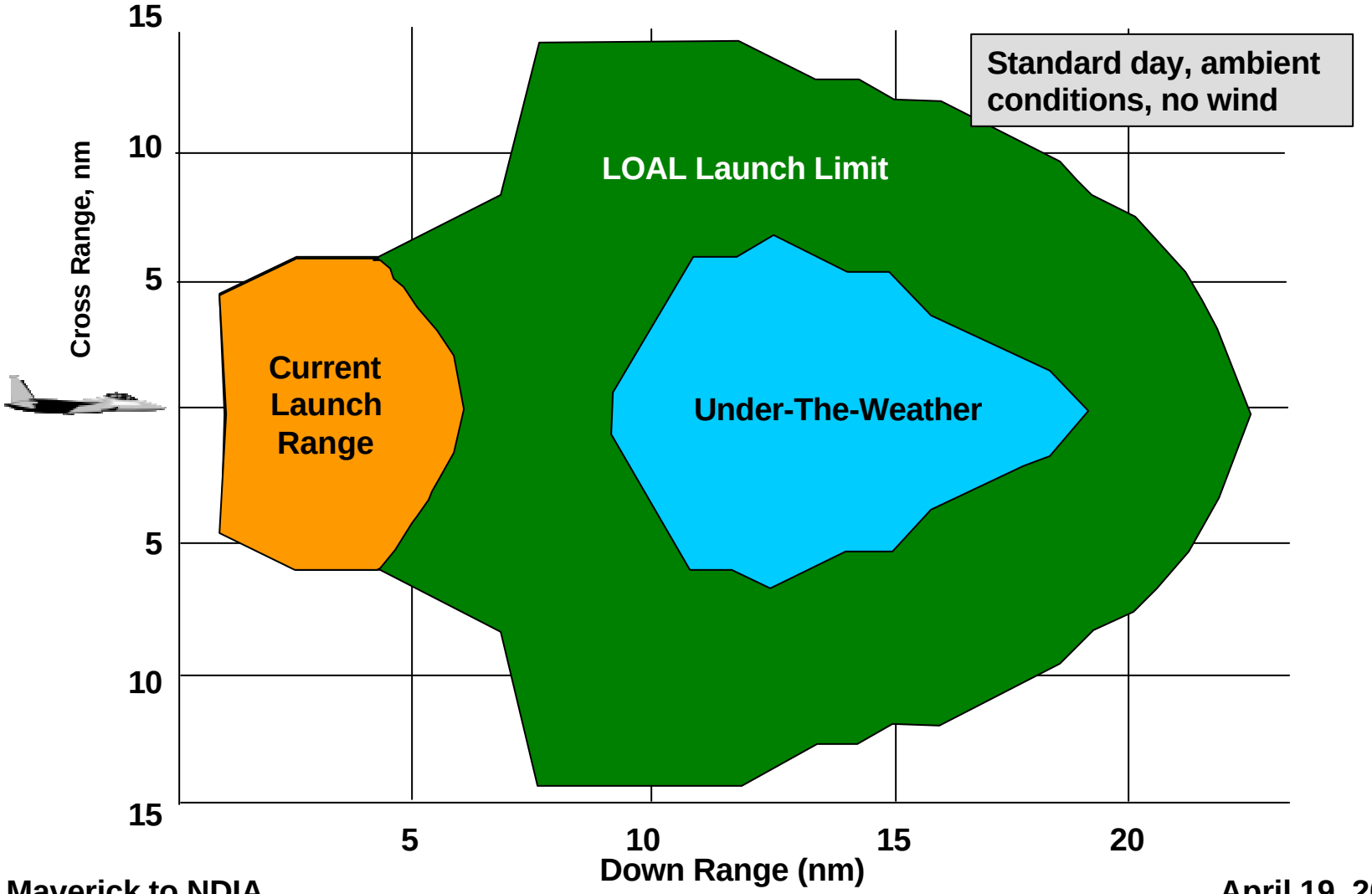
Other Trajectories



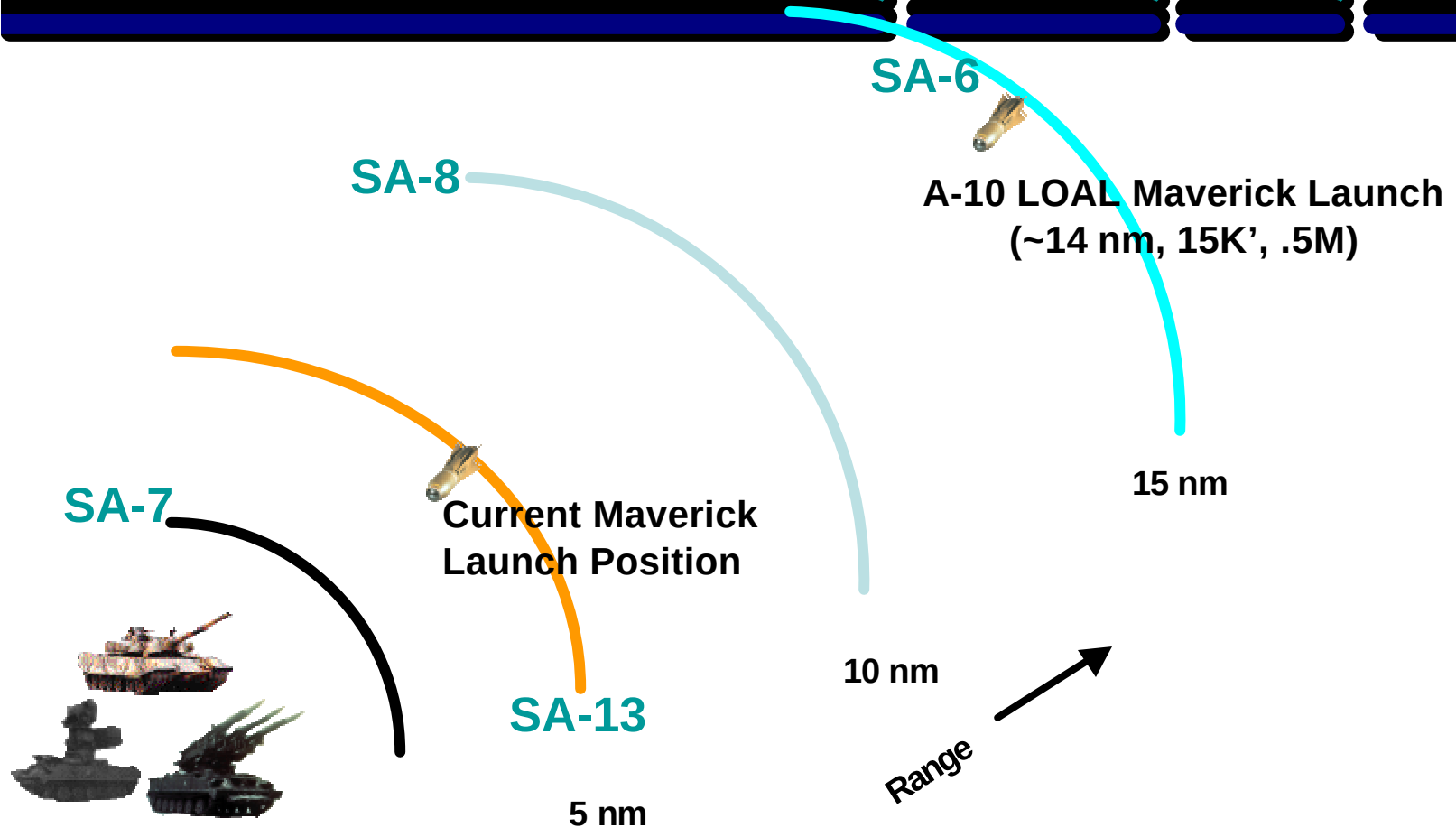
Launch Limits
Mach 0.5 / 15,000 ft



Launch Limits
Mach 0.9 / 25,000 ft

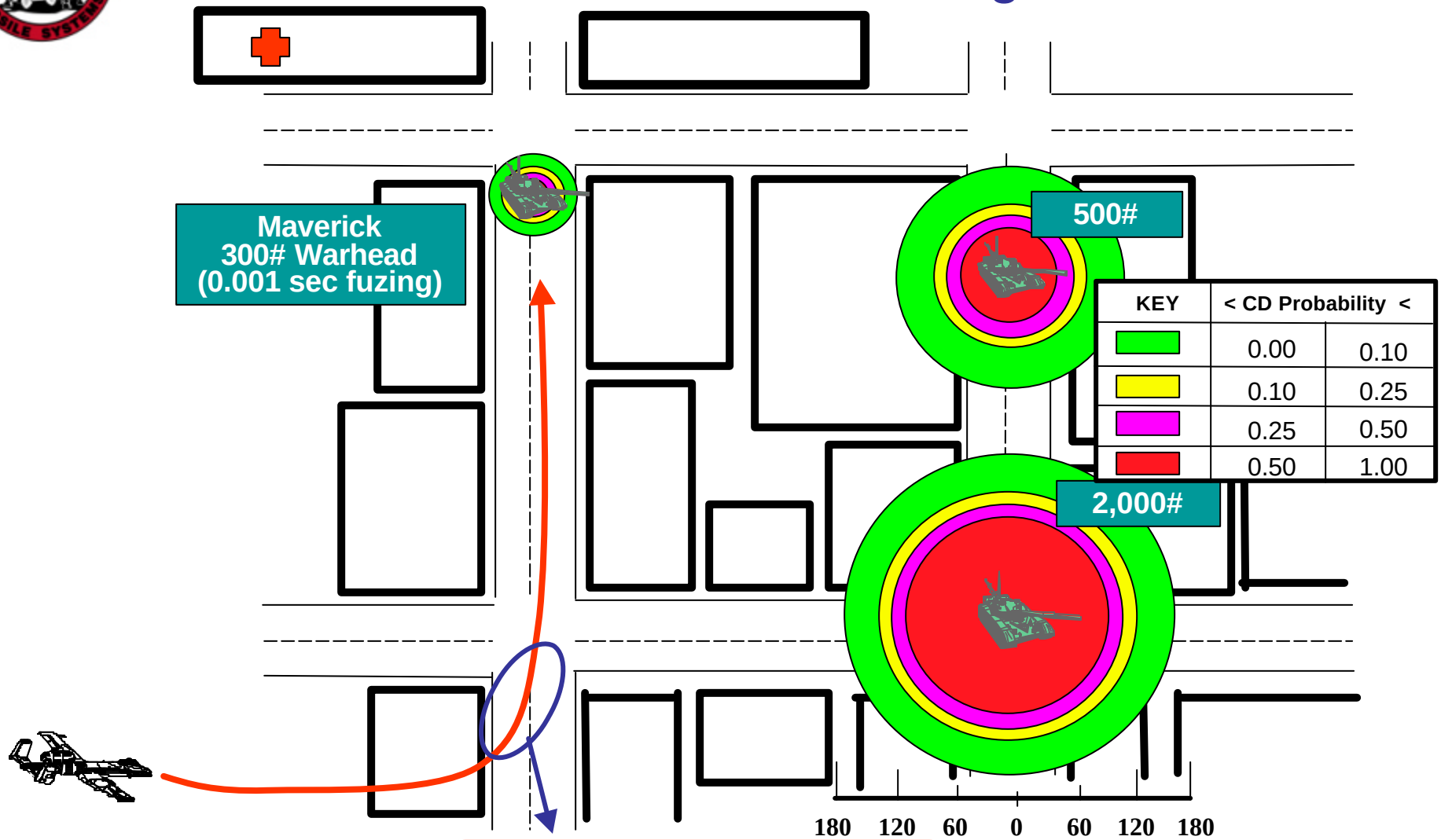


Standoff Outside Point Defenses



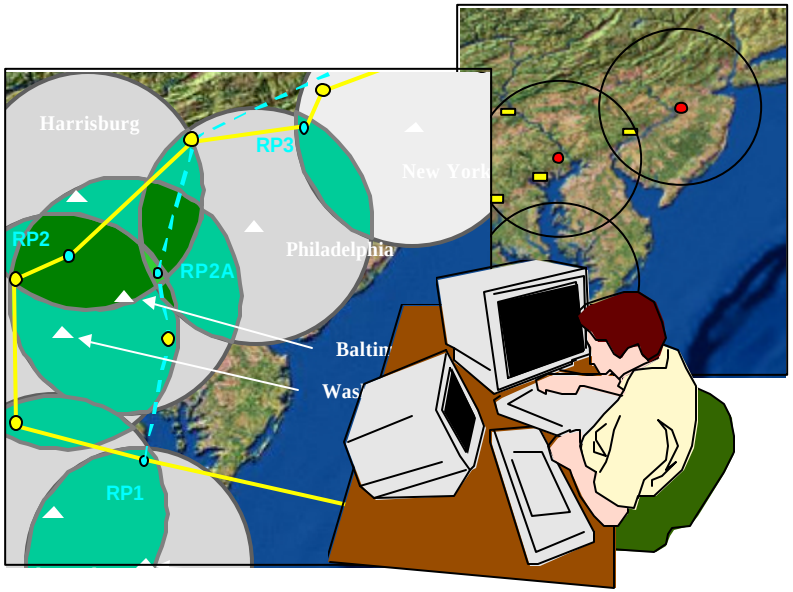
LOAL Permits Launch Beyond Range of Short-Range Defenses

Minimize Collateral Damage



MITL Precision Accuracy
\+ Selectable Attack Parameters
\+ Selectable Fuzing
= Controlled Collateral Damage

AFMSS Mission Planning



New AFMSS MPS A/W/E

- Raytheon will develop and deliver an AFMSS mission planning A/W/E
- Supports release point planning
- Provides Launch Acceptability Region (LAR) predictions
- Conducts mission validation 6-DOF weapon fly-out simulation and datalink margin predictions
- Produces aircrew mission briefing materials (Flight cards)
  - Target coordinates
  - End game conditions
  - Fuze settings
- Open architecture enables migration to PFPS / JMPS

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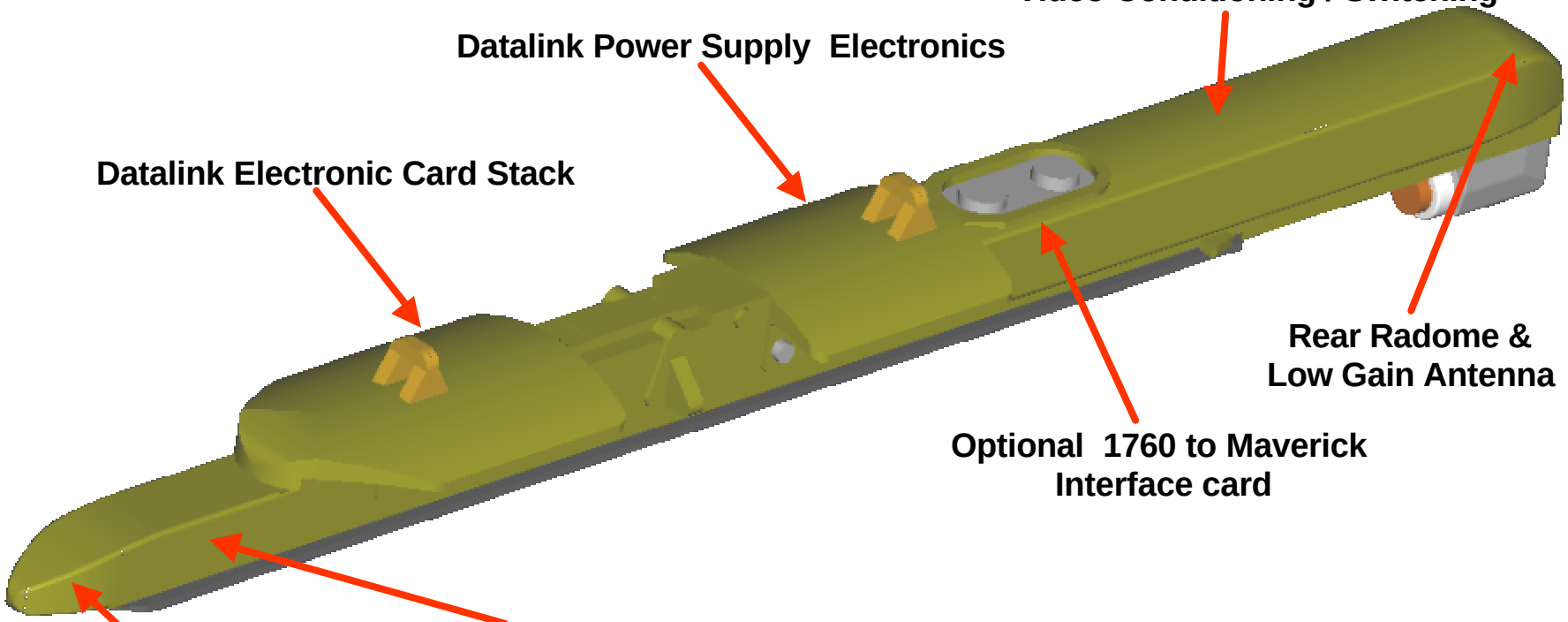
Aircraft Datalink

- **Integrate Datalink Into LAU-117 Launcher**
  - **Use Existing Maverick Interface - No Aircraft OFP Mods Required**
  - **Support Own-Ship Control or Buddy-Guide Within Own-Flight**
- **With BRU-33 or BRU-57**
  - **Would Double Current Maverick Load-Out**

LAU-117 With Datalink



Datalink in Development

- Will enable 20 weapons simultaneously in same geographic area
- High-quality, full-rate (30 Hz) Maverick video
- Low latency (1 frame) video image, low latency on command link
- ComSec capable
- Two year development effort
  - Bench hardware expected this year
  - Flyable hardware planned for next year

Current Potential Customers

- **Customers showing interest in variant of Low Cost Weapon Datalink (LCWDL)**
  - **US Navy (PMA-258) has budgeted for:**
    - **SLAM-ER**
    - **SH-60 weapon**
  - **Interest shown at Wright-Patterson (AFRL)**
    - **Potential for follow-on to existing Predator demo**
  - **Other weapon programs are closely following progress**

LAU-117 Logistics

- **Built In Test - 95% circuitry tested using wrap-around test**
- **Multiple (sequenced) weapon control possible with single LAU-117**
- **Briefcase Test Set with missile simulator for complete pre-flight LAU-117 verification**
- **LAU-117 WRAs would be fleet replaceable**
  - **Software reconfigurable for improved waveforms**
- **Navy variant compatible with current F/A-18 OFP**
  - **Also P-3 and S-3**

Weapon Datalink Logistics

- **Built In Test - 95% circuitry tested using wrap-around test**
- **Potential of 20 users in current frequency bands**
- **Briefcase Test Set with LAU-117 datalink simulator for complete pre-flight WDL verification**
- **WDL would not be fleet replaceable**
- **Software reconfigurable for improved waveforms**

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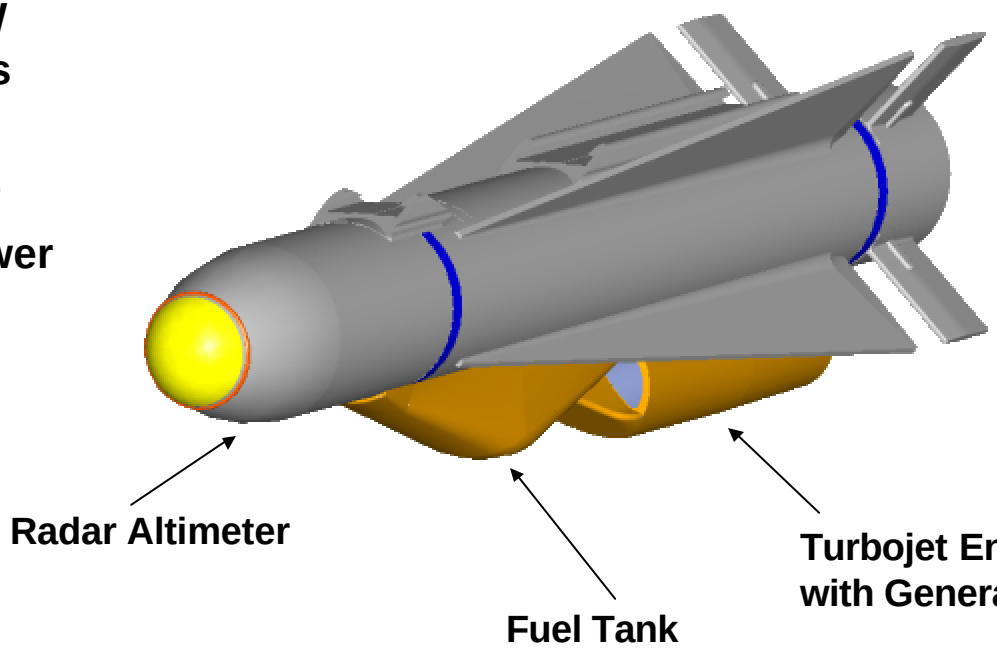
Capability Options

- Attack Targets of Opportunity, including Movers / Movables
  - Own-Ship Self-Targeting
    - LOAL Mavericks can be slaved to on-board targeting sensors (LANTIRN, ATP, Litening, HTS, etc.)
    - Using angle - angle information in conjunction with weapon position, LOAL Maverick can derive GPS coordinates for launch
    - On-board sensor (or another LOAL) can maintain slave target track after launch, generate “moving” coordinates and datalink can provide updates to weapon in-flight
  - Use Off-Board Sensor Tracking (ala AMSTE)
    - Option 1 - Moving-target data is received by controlling aircraft, transferred to datalink LAU-117, then to weapon in flight
    - Option 2 - Link-16 or SADL radio integrated with datalink LAU-117, receives new target data, transfers directly to weapon in flight

Even With Relatively Large Target Location Errors (e.g., Single-Ship MTI), MITL During Endgame Allows Target Acquisition and Effective Attack

Extended Range Maverick

- **Extended Range (ER)**
  - **Same GPS and Datalink Features as LOAL**
  - **Standoff Low-Altitude ASUW Missile for SH-60 Helicopters**
  - **Added Propulsion to Significantly Increase Range**
  - **Generator for Additional Power**
  - **Datalink in Existing LAU-117 Launcher**



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Summary

- LOAL Maverick Offers a System Solution to Support Current Requirements For Maverick-Capable Aircraft
  - MITL Precision Engagement
  - Enhanced Standoff and Survivability
  - Adverse / All Weather
  - Low Collateral Damage
  - BDI Feedback
- Based Upon Low-risk, Proven Technologies
- Can Provide Sizeable Supplement and Complement to Existing MITL Weapons
  - Affordably and Timely
- Can Evolve to Even Greater Capability (Moving / Movable Targets)
- Employment Opportunities:
  - Air Force: A-10, F-15E, F-16
  - Navy / Marines: F-18, P-3, S-3, AV-8

Lock-On-After-Launch (LOAL) Maverick

QUESTIONS?

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End of Presentation